

I claim:

1. A fluid catalytic cracking process comprising:

(a) cracking a crackable hydrocarbon feed by contact with a source of regenerated fluidized cracking catalyst in an enclosed conduit cracking reactor to produce a mixture of cracked hydrocarbon products and spent catalyst containing coke and strippable hydrocarbons and discharging said mixture directly into a closed cyclonic separation means within a vessel;

(b) cyclonically separating said mixture in said separation means into a cracked hydrocarbon product vapor phase with a reduced catalyst content relative to said mixture discharged from said cracking reactor and a spent catalyst phase containing coke and strippable hydrocarbons;

(c) discharging said spent catalyst phase down from said cyclonic separation means into a catalyst stripper within said vessel, said stripper having an upper portion with a stripper cross sectional area, said stripper being in open fluid communication with said vessel and at least a majority of said stripper cross sectional area is open to said vessel;

(d) stripping said spent catalyst in said catalyst stripping means by maintaining spent catalyst as a dense phase fluidized bed fluidized at least in part by injection of stripping steam into a lower portion of said bed to produce:

stripper vapor which is discharged up from said dense phase fluidized bed in said stripping means into said vessel, and stripped catalyst which is discharged from said stripping means into a catalyst regenerator;

(e) regenerating said stripped catalyst in said catalyst regenerator at catalyst regeneration conditions including contact with an oxygen containing gas and burning coke from said

stripped catalyst to produce regenerated catalyst which is recycled to said cracking reactor to crack said feed; and

(f) recovering said stripper vapor discharged up from said dense phase fluidized bed in said stripping means via a snorkel comprising a vertically extending transfer conduit having:

an inlet in said upper portion of said stripper above said dense phase fluidized bed of spent catalyst in said stripper, and

an outlet connective with said cyclonic separation means.

2. The process of claim 1 wherein said closed cyclonic separation means comprises:

at least one primary cyclone sealingly affixed to said reactor outlet and receiving spent catalyst and cracked products discharged from said riser, discharging spent catalyst down via a primary cyclone dipleg into said stripping means and discharging vapor with a reduced spent catalyst content via a primary cyclone vapor outlet line;

said secondary cyclones further separating spent catalyst from vapor and discharging spent catalyst down via a secondary cyclone dipleg into said stripping means and discharging vapor with a further reduced spent catalyst content via a secondary cyclone vapor outlet directly into a transfer line to a product fractionation means, and

said vertically extending conduit transfers stripper vapor from said stripper to said primary cyclone vapor outlet.

Claim 3. The process of claim 2 wherein said outlet of said vertically extending transfer conduit is sealingly affixed to a transfer line connecting the vapor inlet of said secondary cyclone to the vapor outlet of said primary cyclone and wherein

transfer line is fluidly isolated from said vessel except for said vertically extending conduit.

Claim 4. The process of claim 2 wherein at least a portion
5 of said vertically extending transfer conduit is within said primary cyclone dipleg.

Claim 5. The process of claim 4 wherein said outlet of
said vertically extending transfer conduit is within said
10 primary cyclone.

Claim 6. The process of claim 2 wherein said outlet of
said vertically extending transfer conduit is connected to an
inlet of said primary separator.

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Claim 7. The process of claim 2 wherein said outlet of
said vertically extending transfer conduit is connected to an
inlet of said secondary separator.

20 Claim 8. The process of claim 1 wherein a purge gas stream is added to an upper portion of said vessel at an elevation above an elevation of said cyclone separation means in an amount equal to 0.5 to 10 mole % of said stripper vapor.

25 Claim 9. The process of claim 1 wherein at least a portion of said stripper vapor discharged up from said dense phase fluidized bed in said stripping means into said vessel enters said closed cyclone system by passing up through said vessel to an opening in an inlet to said primary or said secondary
30 cyclone.

Claim 10. A fluid catalytic cracking process comprising:

(a) cracking a crackable hydrocarbon feed by contact with a source of regenerated fluidized cracking catalyst in an enclosed conduit cracking reactor to produce a mixture of cracked hydrocarbon products and spent catalyst containing coke and strippable hydrocarbons and having a temperature above 1000°F and sufficiently high to cause thermal cracking of cracked hydrocarbon products and discharging said mixture from said enclosed conduit directly into a closed cyclone separator system comprising primary and secondary cyclone separators within a vessel;

(b) cyclonically separating said mixture in said primary cyclone separator into:

a cracked product vapor phase comprising at least 90 mole % of said hydrocarbon product vapor discharged from said riser and less than 5 wt % of said spent catalyst discharged from said riser, which is discharged via a primary cyclone vapor outlet connective with an inlet to said secondary cyclone, and

a spent catalyst phase comprising at least 95 wt % of said spent catalyst discharged from said riser and less than 10 mole % of said vapor discharged from said riser, which is discharged down via a primary cyclone dipleg into a catalyst stripper in a lower portion of said vessel;

(c) cyclonically separating said vapor phase discharged from said primary separator in said secondary cyclone separator into:

a cracked hydrocarbon product vapor phase having less than 1 wt % of said spent catalyst discharged from said riser, which is discharged via a secondary cyclone vapor outlet to a line connective with a product fractionator, and

a spent catalyst phase, comprising less than 5 wt % of spent catalyst discharged from said riser and less than 2 mole % of vapor discharged from said riser, which is discharged from a secondary cyclone dipleg into said catalyst stripper;

5 (d) stripping in said catalyst stripper spent catalyst discharged from said primary and secondary cyclone diplegs in a dense phase fluidized bed fluidized at least in part by injection of stripping steam to a lower portion of said bed to produce:

10 stripper vapor which is discharged up from said fluidized bed catalyst stripper, and

stripped catalyst which is discharged from said catalyst stripper into a catalyst regenerator;

(e) regenerating stripped catalyst in said catalyst
15 regenerator at catalyst regeneration conditions including contact with an oxygen containing gas to produce regenerated catalyst which is recycled to said cracking reactor; and

(f) transferring from said stripper to said closed cyclones at least a majority of said stripper vapor discharged up from
20 said fluidized bed in said stripper via a snorkel having:

a lower snorkel inlet above said dense phase of fluidized catalyst in said stripper,

an upper snorkel outlet fluidly connected with said cyclone separators, and

25 a vertical transfer conduit section fluidly isolated from said vessel containing said cyclone separators and physically attached to or within at least one of said primary cyclone diplegs.

30 Claim 11. The process of claim 10 wherein said vertical transfer conduit of said snorkle is at least partially inside said primary cyclone dipleg.

Claim 12. The process of claim 11 wherein said primary cyclone dipleg is a vertical cylinder having a longitudinal axis, said snorkle transfer conduit is a vertical cylinder
5 having a longitudinal axis and said snorkle transfer conduit is inside and axially aligned with said primary cyclone dipleg.

Claim 13. The process of claim 10 wherein a stripper cap located within said vessel extends horizontally across at least
10 a majority of an upper surface of said stripper.

Claim 14. An apparatus for fluidized catalytic cracking of hydrocarbon feed comprising:

a reactor vessel, a riser reactor having a base section and
15 an upper section;

an inlet in the base of the riser for the hydrocarbon feed;
an inlet in the base of the riser for a source of hot regenerated catalytic cracking catalyst;

an outlet in the upper section of the riser for discharging
20 catalytically cracked products and spent catalyst into said reactor vessel;

a closed cyclone separation means within said vessel receiving cracked products and spent catalyst from said riser for separation of cracked products from spent catalyst;

25 a spent catalyst stripper means in a base portion of said reactor vessel beneath said closed cyclone having a spent catalyst inlet for catalyst from said closed cyclone, a stripping gas inlet in a lower portion thereof, a stripper vapor outlet in an upper portion thereof and a stripped catalyst
30 outlet;

a stripper vapor transfer conduit having an inlet in open fluid communication with said vessel and an elevation

intermediate said cyclonic separation means and said stripper vapor outlet and an outlet sealingly affixed to said cyclone separation means for transfer of stripper vapor to said cyclone separation means;

5 a catalyst regenerator having an inlet for an oxygen containing regeneration gas, an inlet for stripped catalyst from said stripper catalyst outlet, an outlet for flue gas and an outlet for regenerated catalyst for recycle of regenerated catalyst connective with the base of the riser reactor.

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16. The apparatus of claim 15 wherein said cyclone separation means comprises at least one primary cyclone connected to said reactor discharging solids down into said stripper via a catalyst standpipe and discharging vapor via a
15 primary cyclone vapor conduit into at least one secondary cyclone, and said outlet of said stripper vapor transfer conduit is sealingly affixed to said primary cyclone vapor conduit.

17. The apparatus of claim 15 wherein said cyclone
20 separation means comprises at least one primary cyclone connected to said reactor discharging solids down into said stripper via a catalyst standpipe and discharging vapor via a primary cyclone vapor conduit into at least one secondary cyclone, and
25 said stripper vapor transfer conduit is at least partially contained within said catalyst standpipe and said outlet is within said primary cyclone.